IGCC PROJECT DEVELOPMENT AND FINANCE SEMINAR

NOVEMBER 14-16, 2005

RITZ-CARLTON ST. LOUIS

ST. LOUIS, MO

ConocoPhillips

Operational Experience at the Wabash River Project

Thomas A. Lynch

Chief Engineer, Gasification

An Energy Company

Oil

Coal

Oil Sands

Natural Gas

Petroleum Coke

Transportation Fuels

Gas-to-Liquids

Gasification

Electricity

Shale Oil

LNG

Overview

E-Gas Technology history

Gasification 101
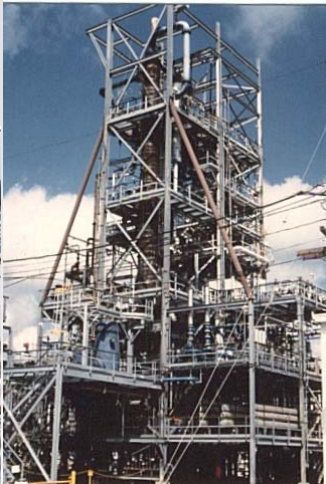
Cost & Performance

Environmental Benefits

E-Gas Technology Projects & Improvements

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E-Gas Gasification Commercial Feedstock Offerings and Gasifier Scale-up

Wabash
1995 - 2005
2,600 TPD

For 2010 Start-up
E-Gas Technology
Commercial
Offerings

Bituminous
Sub-Bituminous
Petcoke

LGTI 1987–1995
2,400 TPD

1979
Proto 1 - 400 TPD

1983
Proto 2 - 1600 TPD

1975 Pilot

36 TPD

Bituminous IL #6 coal
Petcoke – Multiple refineries.

Sub-Bituminous
Rochelle Mine

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Wabash River

One of the

Cleanest Coal Fired Power Plants

in the World

1.7 million tons of bituminous coal

1.3 million tons of petcoke

- **2500 TPD bituminous coal feed**

- **Operational since 1995 at Cinergy's Wabash River Plant**

- **SG Solutions LLC now owns Syngas Plant, ConocoPhillips provides professional services on site**
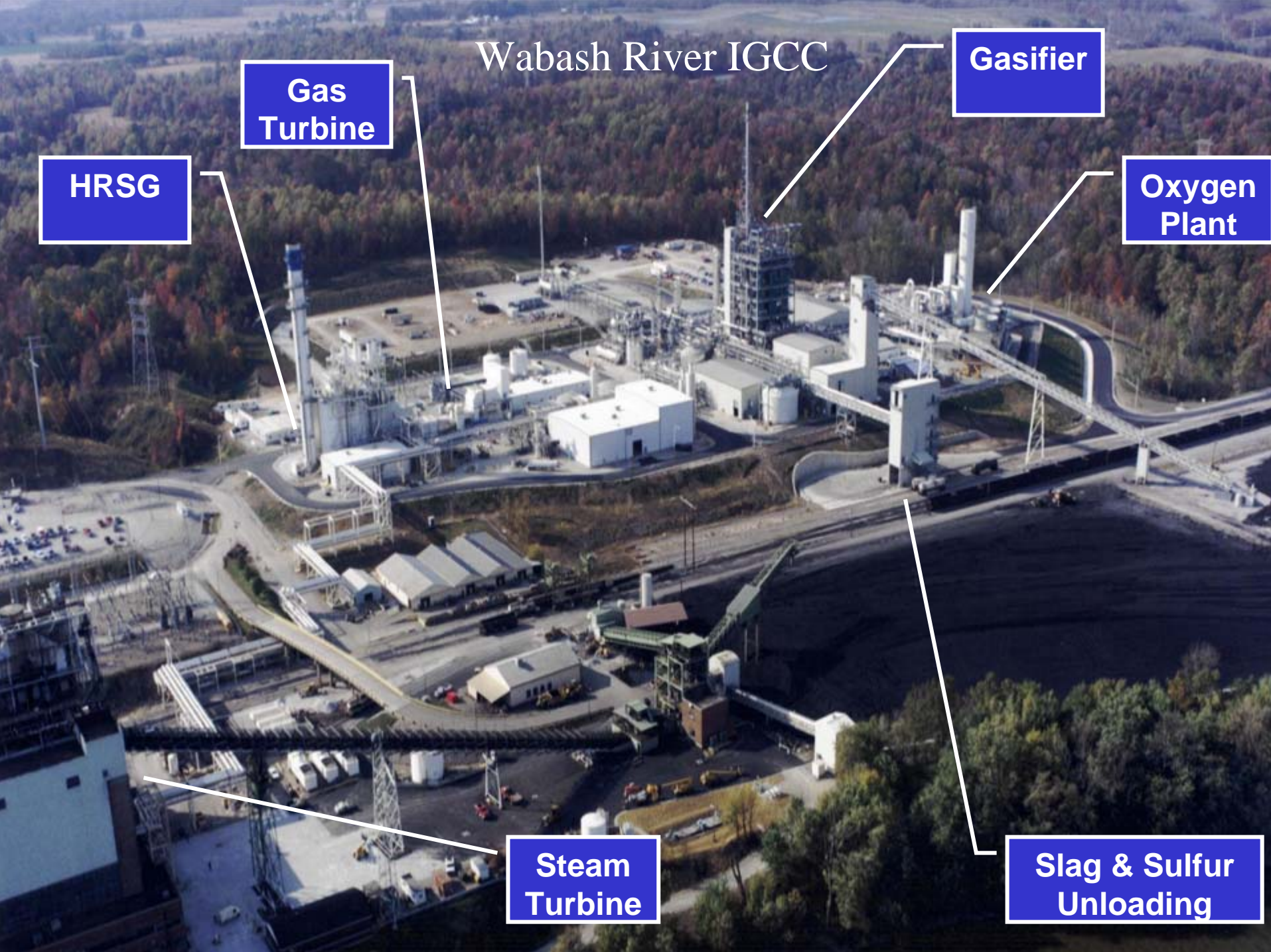
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Wabash River IGCC

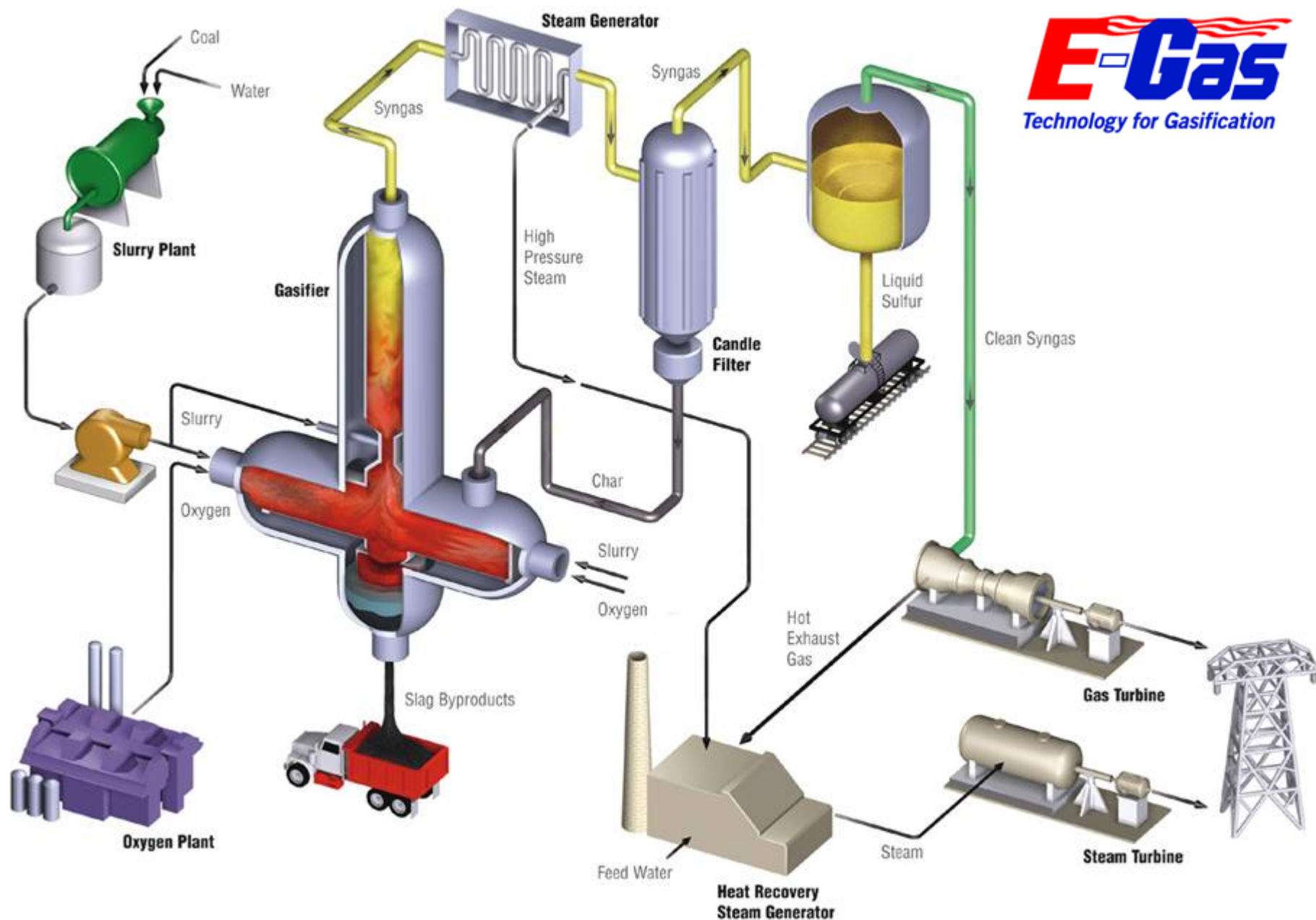Gas Turbine

Gasifier

HRSG

Oxygen Plant

Steam Turbine

Slag & Sulfur Unloading

Wabash River Project Overview

- **Coal Gasification Combined Cycle Repowering**

- **262 MWe Net Output by repowering 100 MW 1953 PC Unit**

- **Operational since 1995**

- **Bituminous Coal and Petcoke, up to 7 % S**

- **Heat Rate Improved by 20% (~ 8900 Btu/kWh   HHV)**

- **One of the Cleanest Coal/Coke Fired Power Plants in the World**

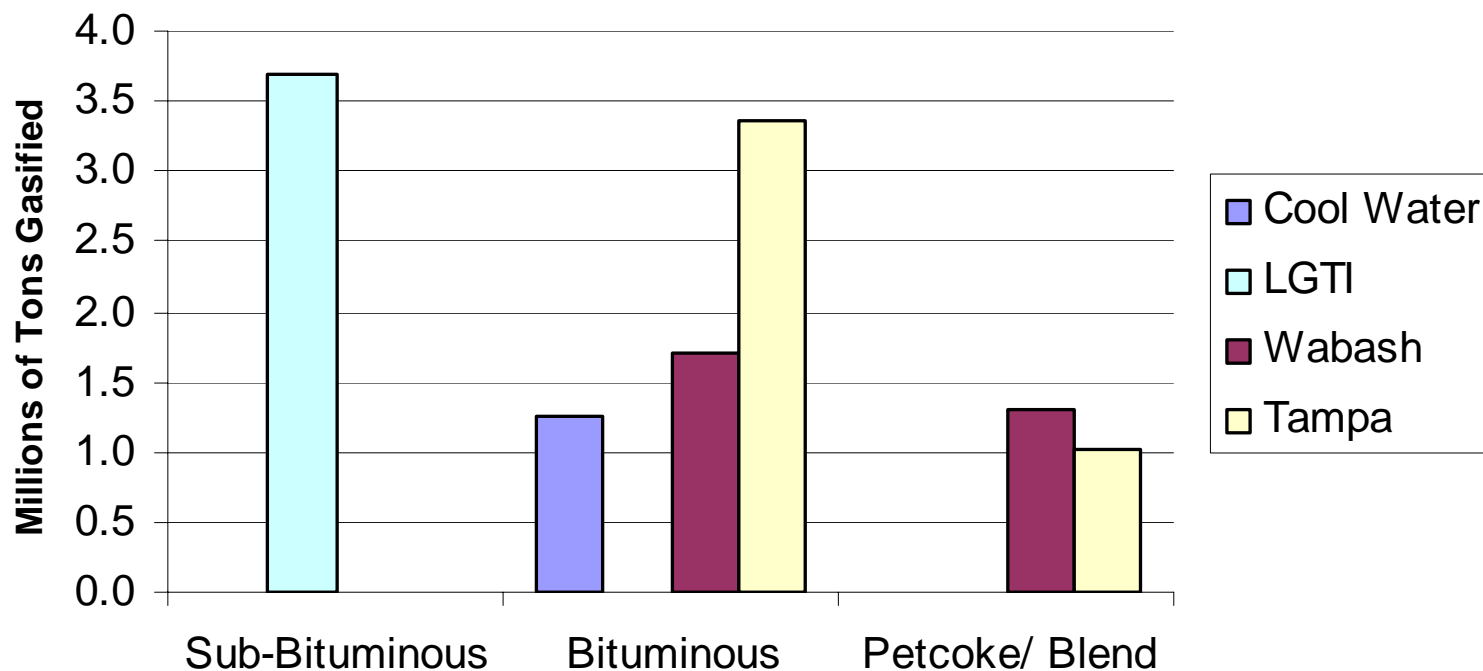- **Highest demonstrated petcoke throughput of any gasifier**

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Coal
Water

Slurry Plant

Steam Generator

Syngas

Syngas

Gasifier

Syngas

High Pressure Steam

Candle Filter

Liquid Sulfur

Clean Syngas

E-Gas

Technology for Gasification

Slurry

Char

Oxygen

Slurry

Oxygen

Slag Byproducts

Oxygen Plant

Hot Exhaust Gas

Gas Turbine

Feed Water

Steam

Heat Recovery Steam Generator

Steam Turbine

U.S. Coal-to-Power Gasification

Coal Used: 37 % Sub-Bituminous - 63% Bituminous

Source: EPRI, Tampa Electric, and ConocoPhillips

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Performance and Cost Overview

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Annual Availability Profile

For a SINGLE TRAIN Gasification-Power Generation Tandem - **Coal**

January
February
March   > 91% Availability
April
May   21 day planned outage
June
July   >80% Annual
August   > 91% Availability
September   Availability
October
November   21 day planned outage
December   > 91% Availability

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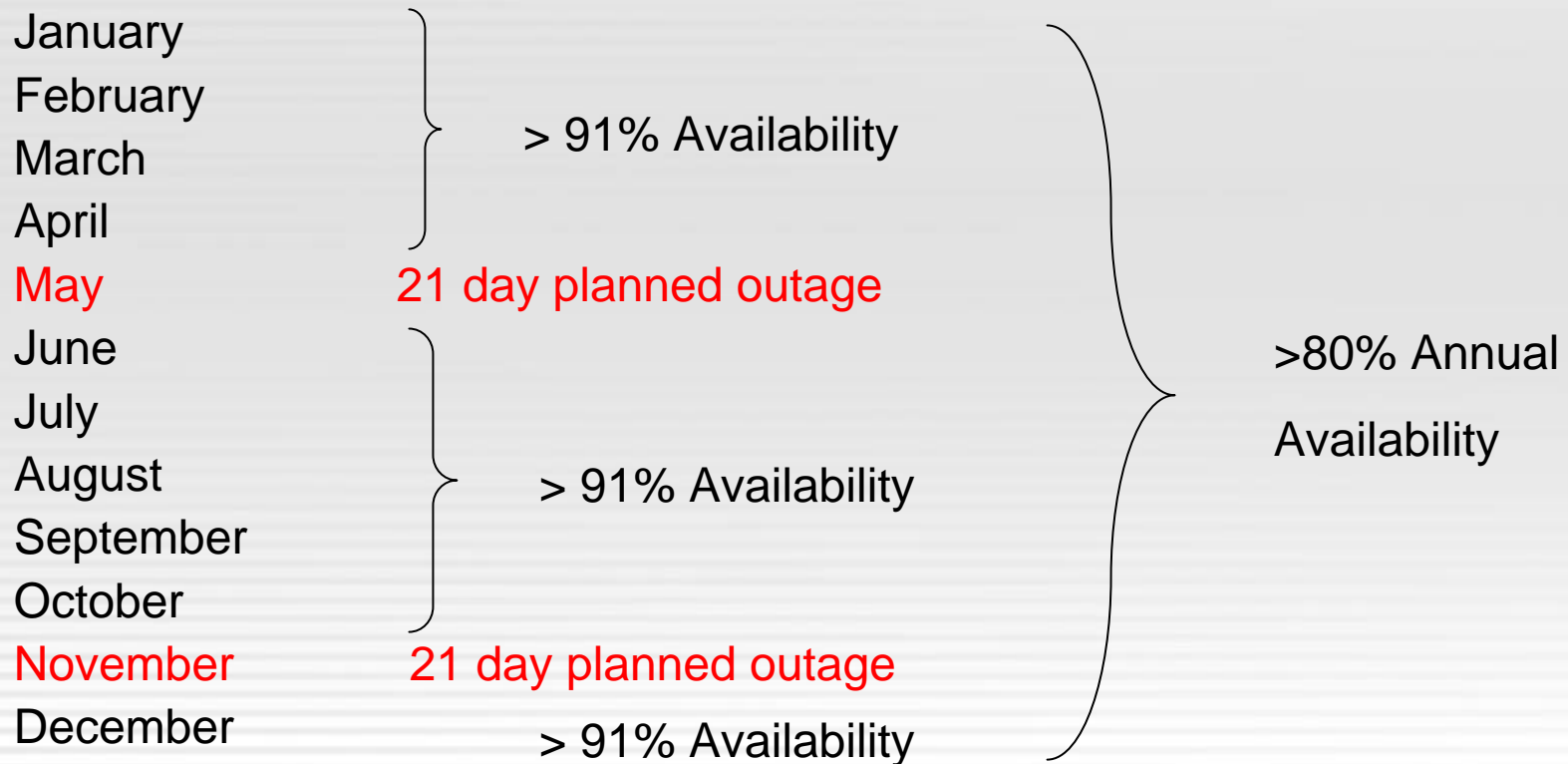
Coal IGCC Reference Plant
Availability Projections (No Spare Gasification Train)

81% Annual Availability

90% + Seasonal Availability

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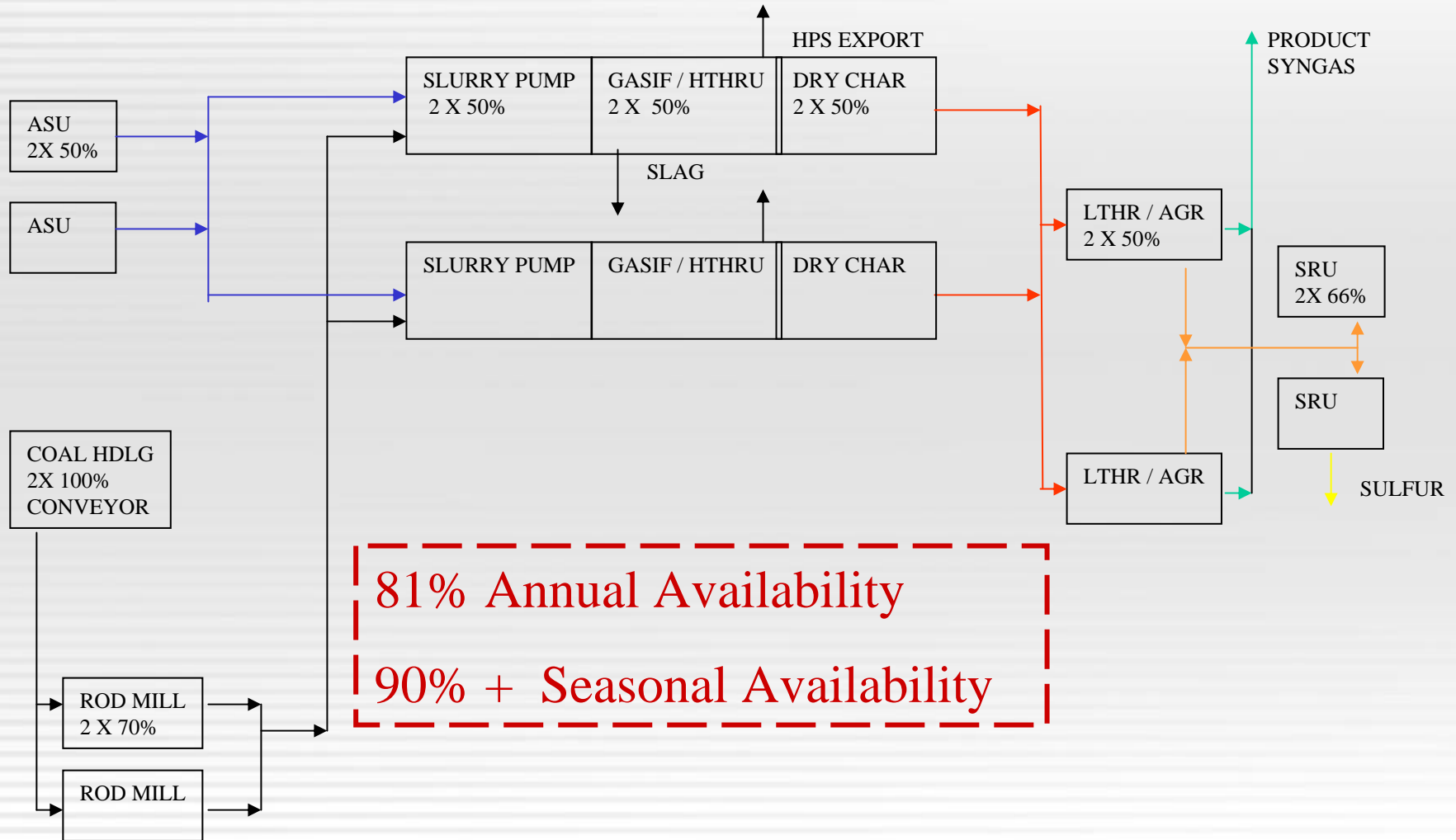
Coal IGCC Reference Plant
Availability Projections (With Spare Gasification Train)

3rd 50% train - ~ $117/kW

Adds 5% to seasonal availability or

10+ % to annual availability
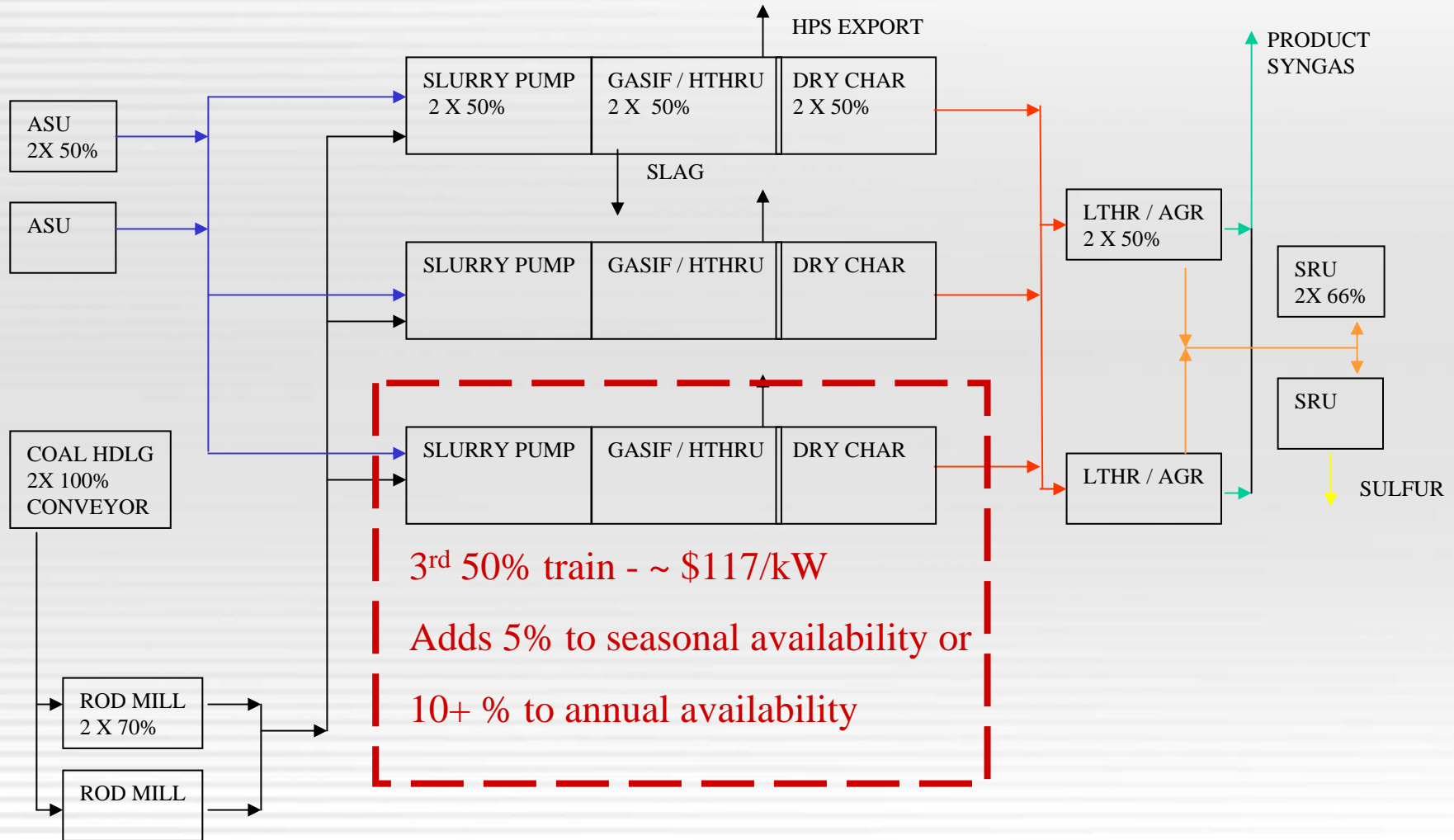
E-Gas IGCC Installed Costs by Fuel Type
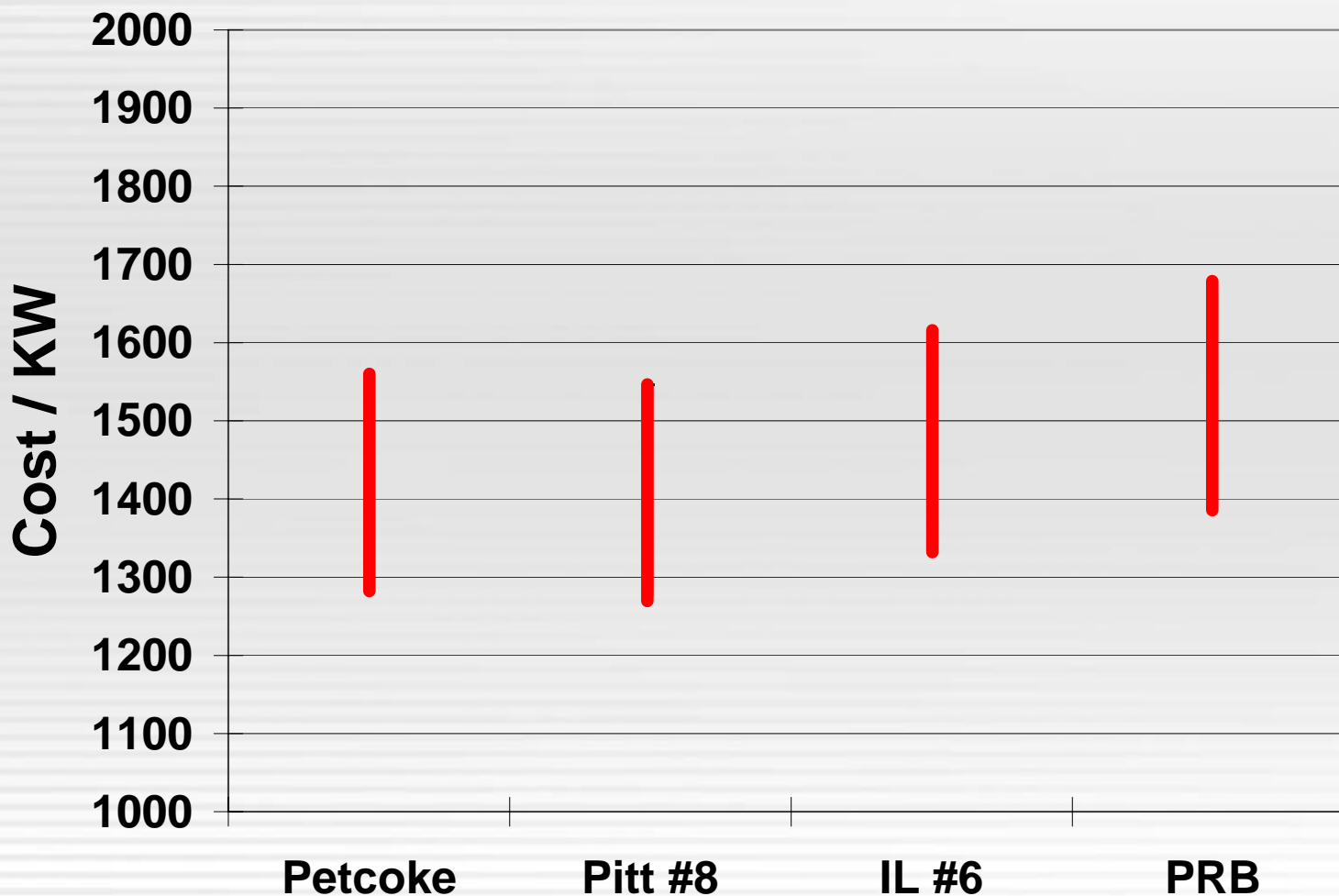
Costs for IGCC with Amine Based AGR

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Relative Power & Heat Rate Comparisons

Net Power Output

Data Relative to Petcoke Amine Case
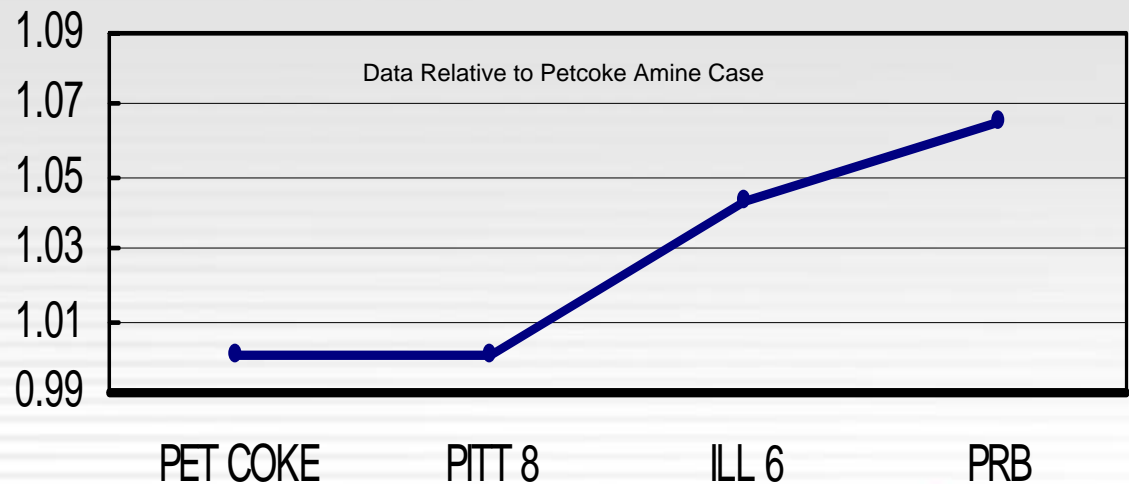
Estimated Performance Data

Relative Heat Rate
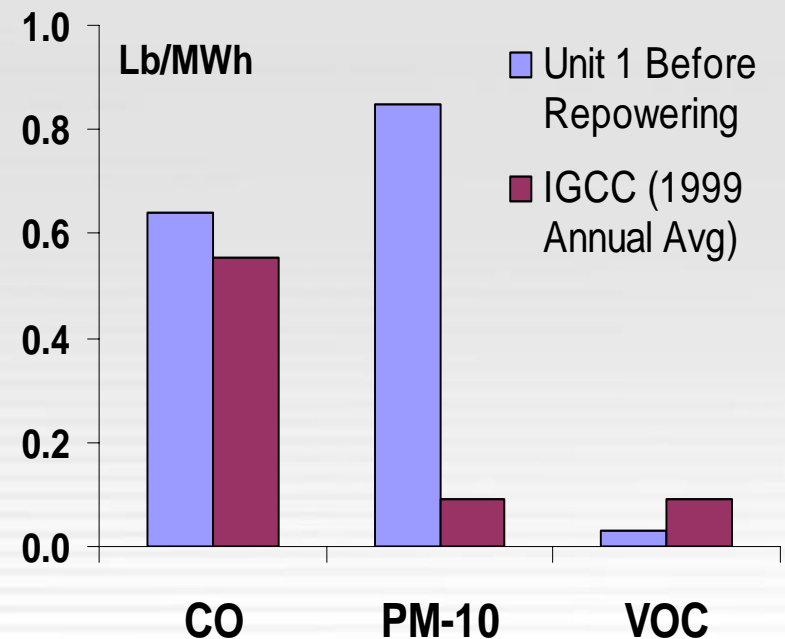

Data Relative to Petcoke Amine Case

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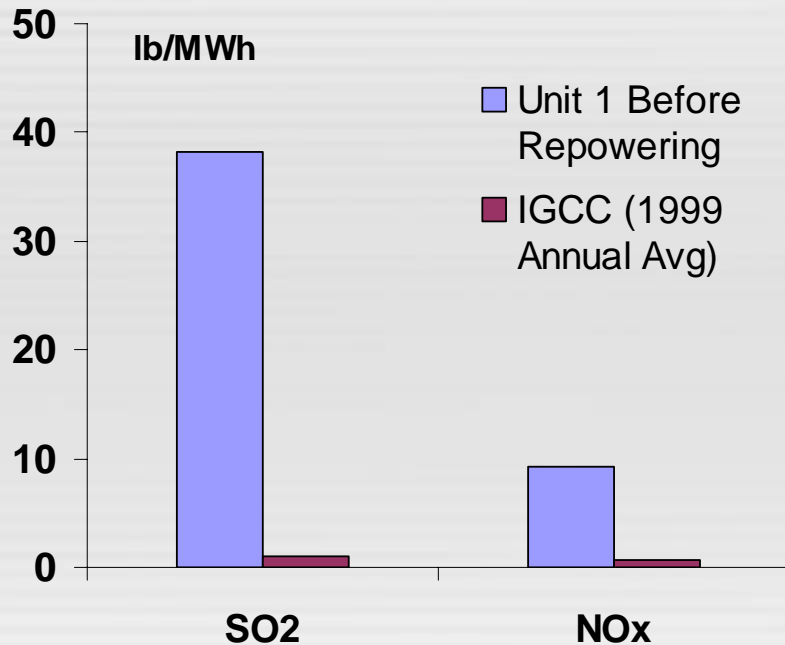
Superior Environmental Performance

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Comparison of Wabash Emissions before and after IGCC Repowering

lb/MWh

- Unit 1 Before Repowering
- IGCC (1999 Annual Avg)

SO2   NOx

Lb/MWh

- Unit 1 Before Repowering
- IGCC (1999 Annual Avg)

CO   PM-10   VOC

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Coal Plant Main Stack Permit Targets

Permit Targets	IGCC Amine Based	IGCC Selexol™ with SCR	SCPC[1]
SO$_2$ Emission Rate (lb/mmBtu of coal feed)	0.03	0.01	0.16
NO$_x$ Emission Rate (lb/mmBtu of coal feed)	0.06	0.02	0.07
Total NO$_x$ & SO$_2$ TPY (based on 630MW Plant –IL6)	1,640	500	4,500

1) Wisconsin Electric Power SCPC information from April 2003 Draft Environmental Impact Statement, Elm Road Generating Station, Volume 1, Public Service Commission of Wisconsin & Department of Natural Resources, Table 7-11, p. 155 (Pittsburgh No. 8 coal)

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Pollutant Removal Advantages

Mercury Removal

- 90-95% removal utilizing carbon beds

Carbon Dioxide

- Gasification is carbon capture friendly

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Solid Byproducts – not Wastes

- Sulfur - 99.99% pure
  100,000+ tons sold at Wabash
  Equivalent to 400,000,000 lbs of SO_2

- Slag - Black, glassy sand like material
  Inert, passes TCLP & UTS
  Asphalt
  Construction backfill
  Landfill cover

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E-Gas Technology Improvements and Projects

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# Current E-Gas Technology Commercial Design Features

Air Separation Unit	50 Year Old Technology, integration
Combined Cycle Plant	95% of US Generation 1997-2002 Nitrogen dilution + air integration
Gasification	Wabash ~40% novel technology. New Plant < 5%
Rod Mill	Same as Wabash & LGTI
Slurry Pumps	Same as Wabash & LGTI
Gasifiers	Same Vessel, increased use of 2nd stage
Syngas Cooler	Same as Wabash & LGTI
Particulate Removal	Wabash + Cyclone (demo under way)
Gas Clean Up	Common Refinery Technology + COS from Wabash, Mercury removal
Steel/Piping/Wire	Economy of Scale

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E-Gas Project Consortium Design Templates

Sub-Bituminous Coal IGCC Template

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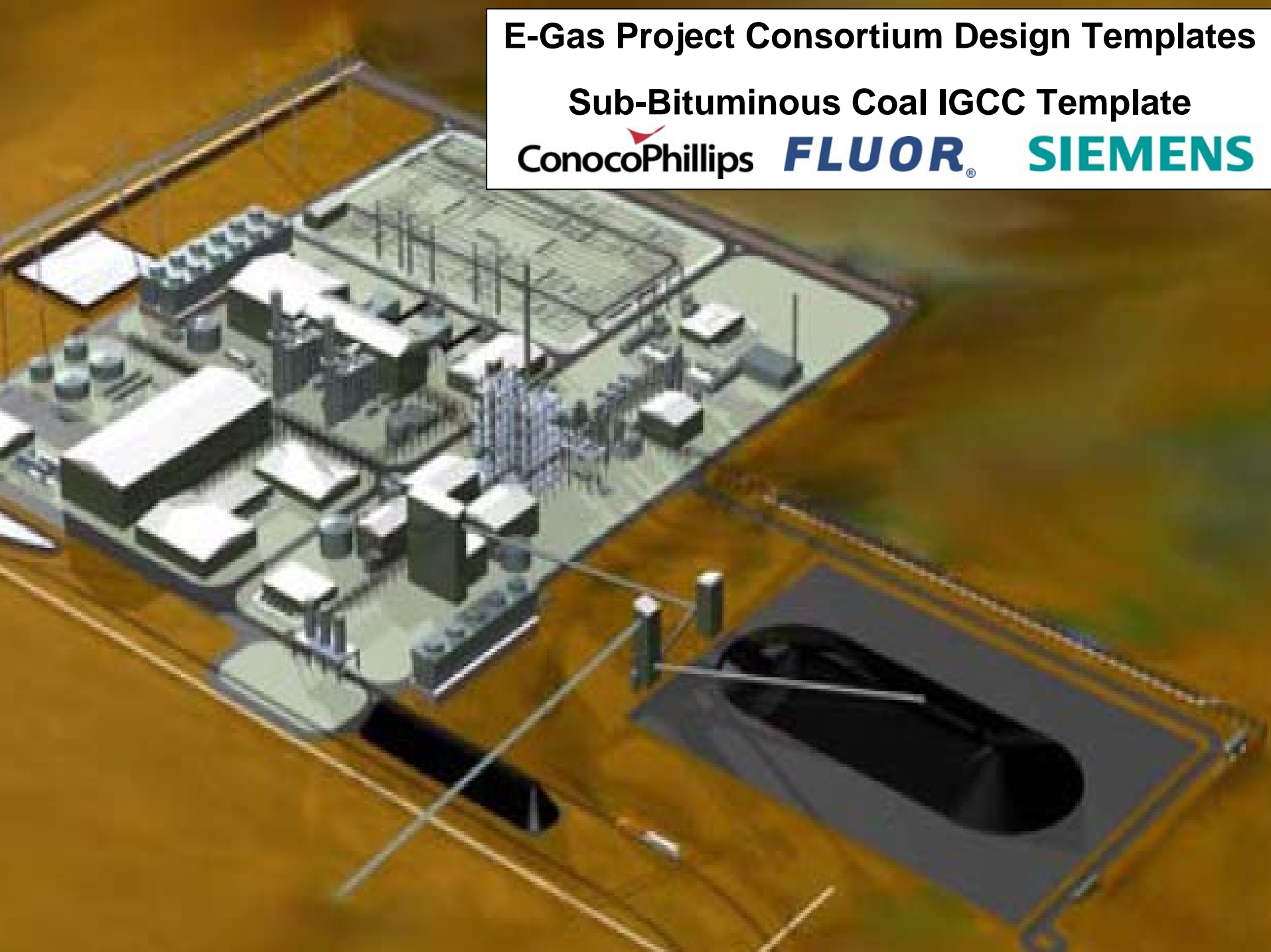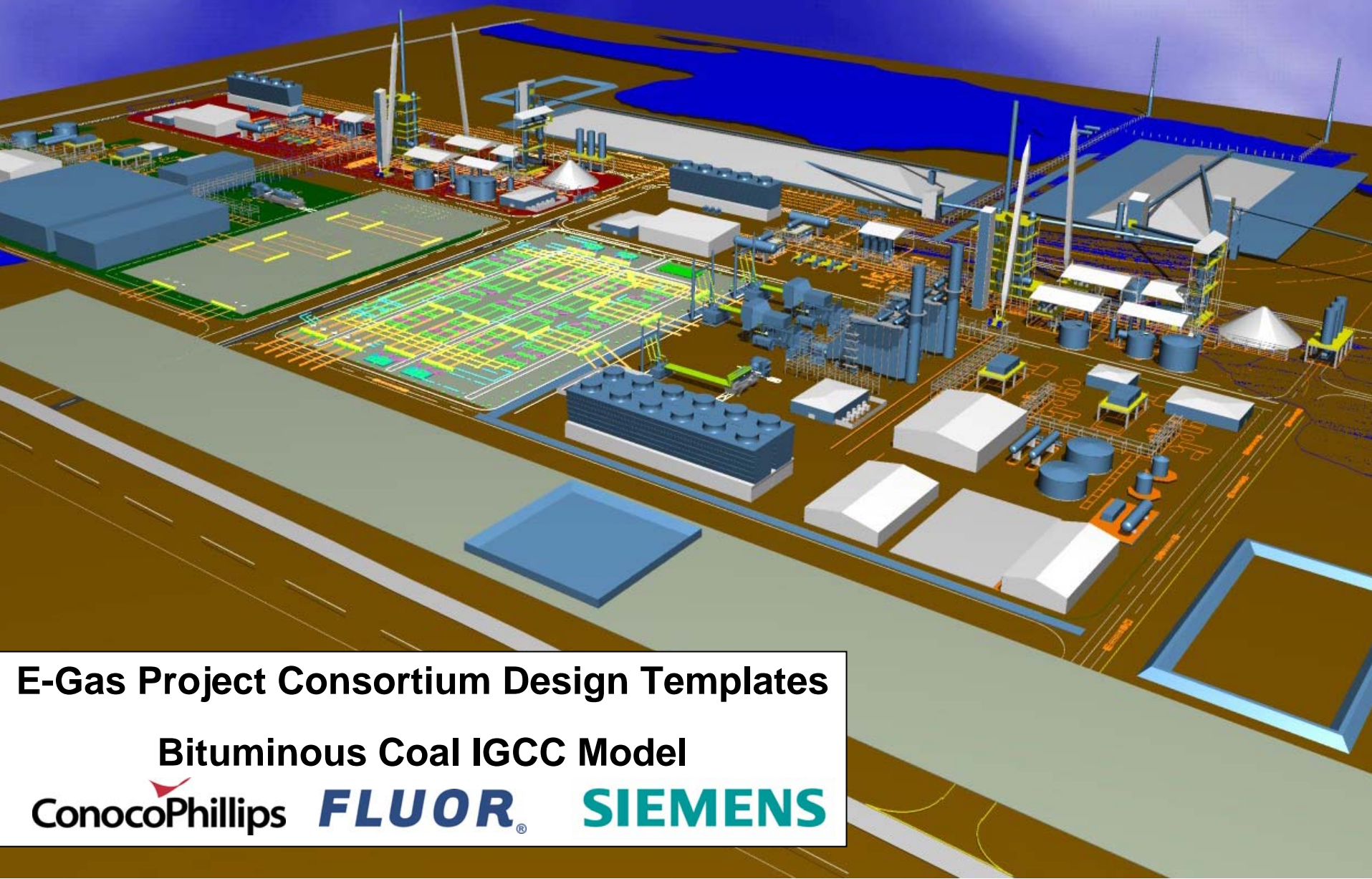
E-Gas Project Consortium Design Templates

Bituminous Coal IGCC Model

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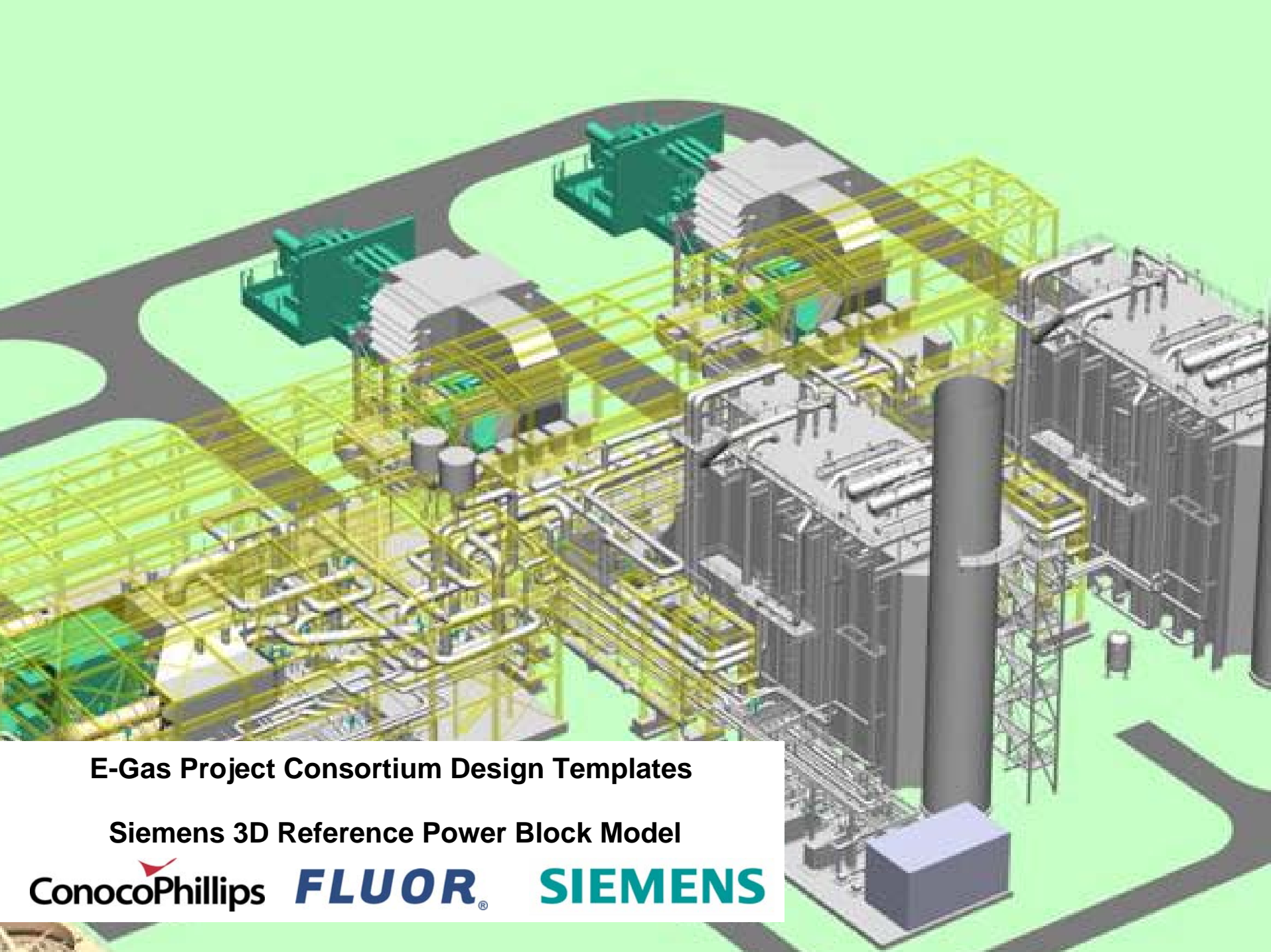
E-Gas Project Consortium Design Templates

Siemens 3D Reference Power Block Model

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E-Gas Technology – Well Positioned to Meet Today's Energy Needs

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